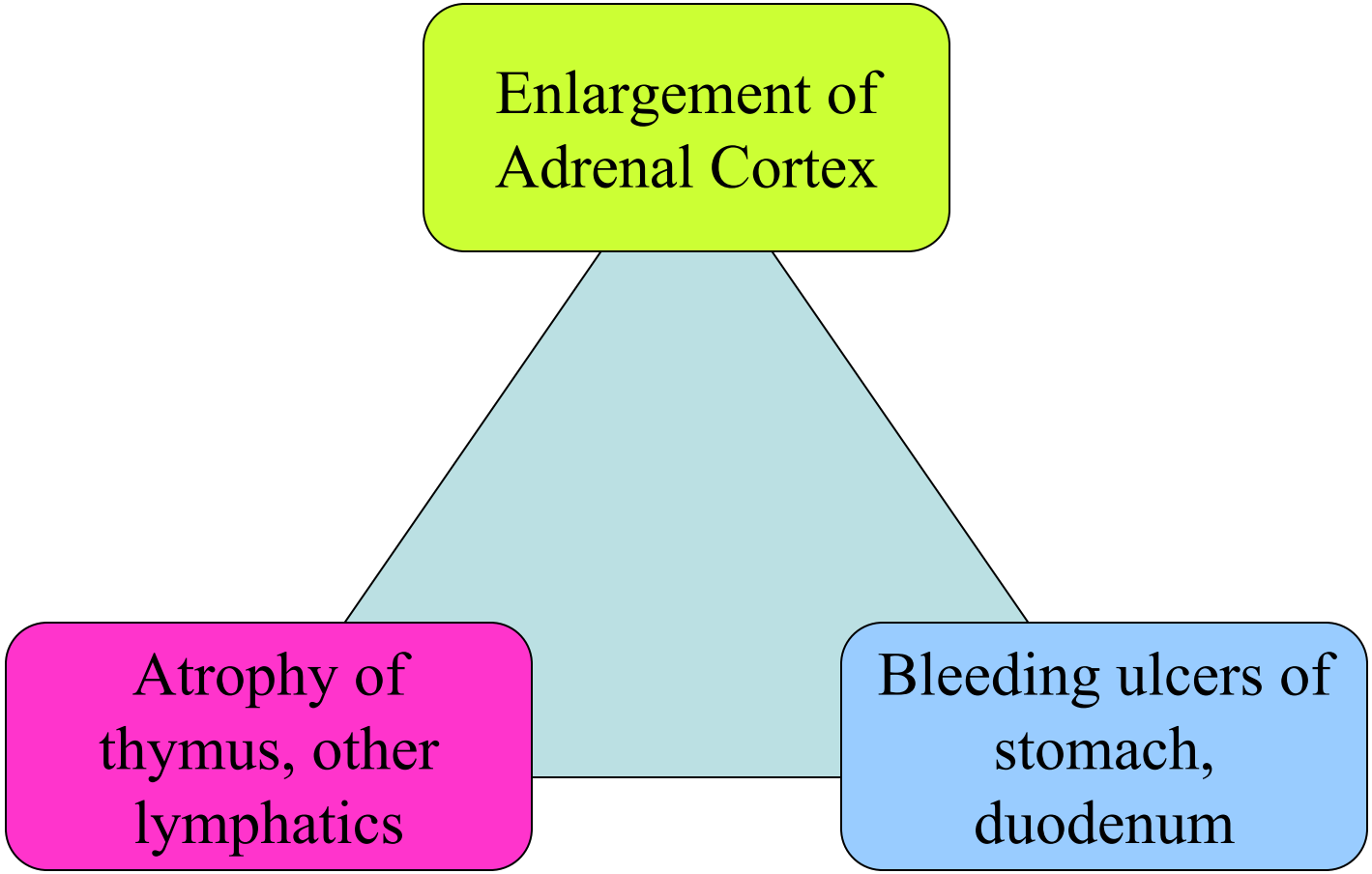
Stress and Disease

Stress Effects Triad



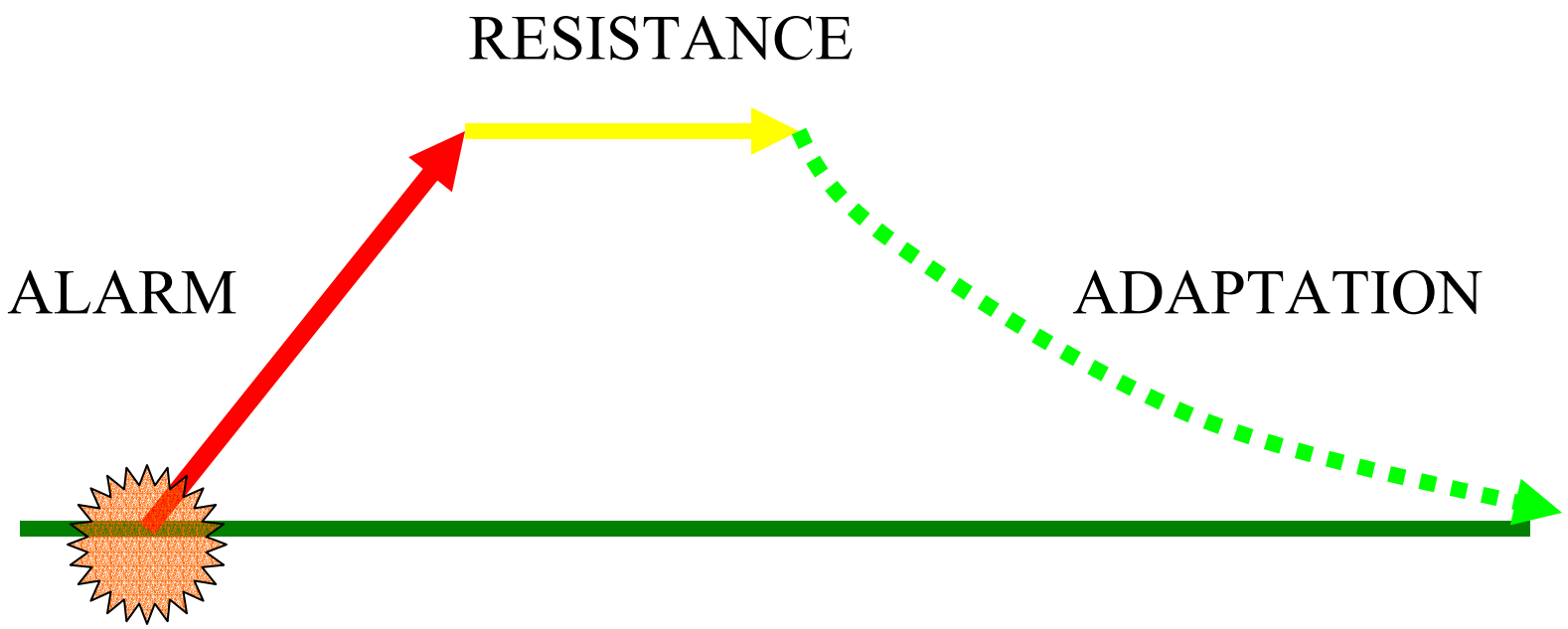
Stress

- Non-specific state of physical and psychological arousal to stressor

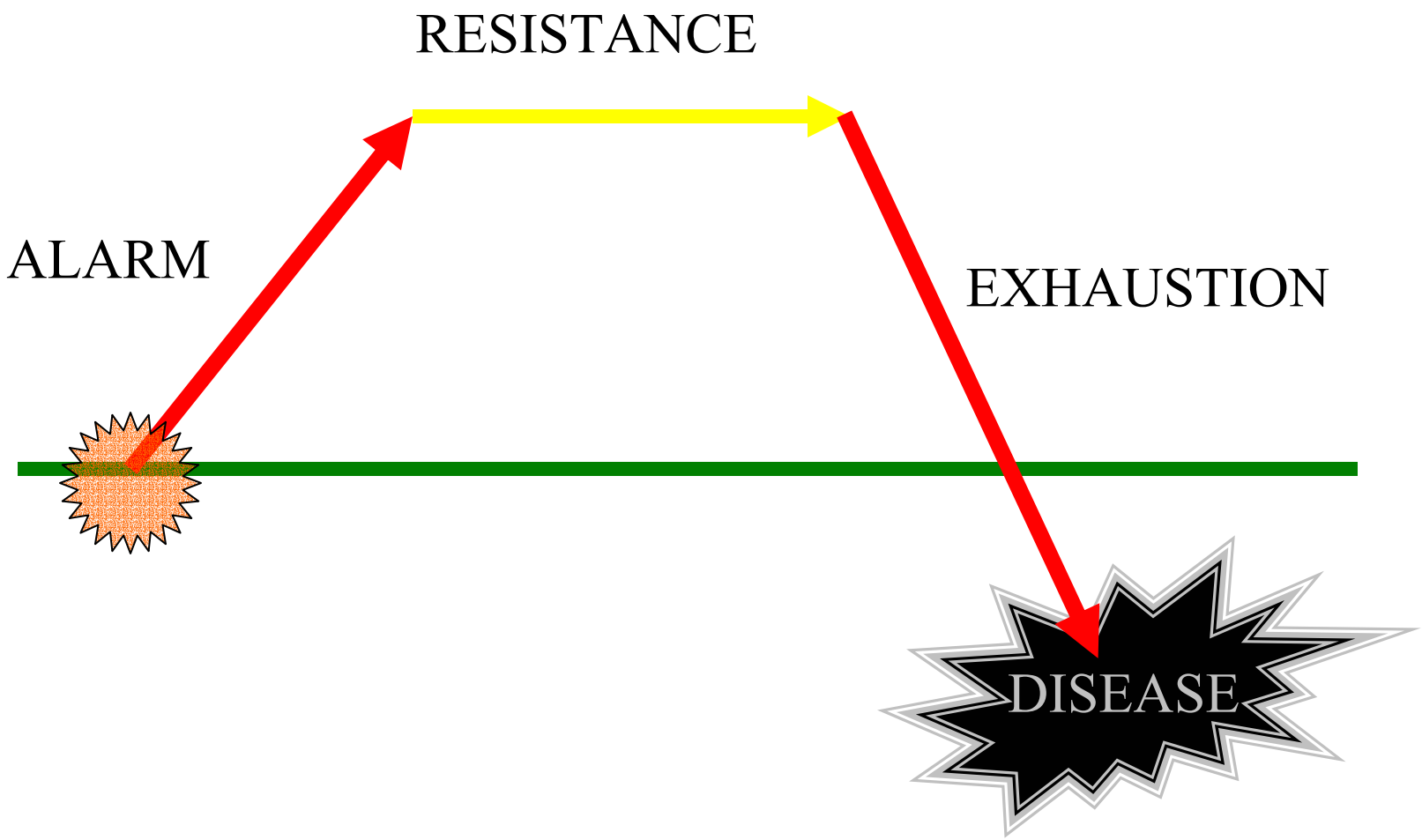
Stressor

- Any stimulus that triggers stress response

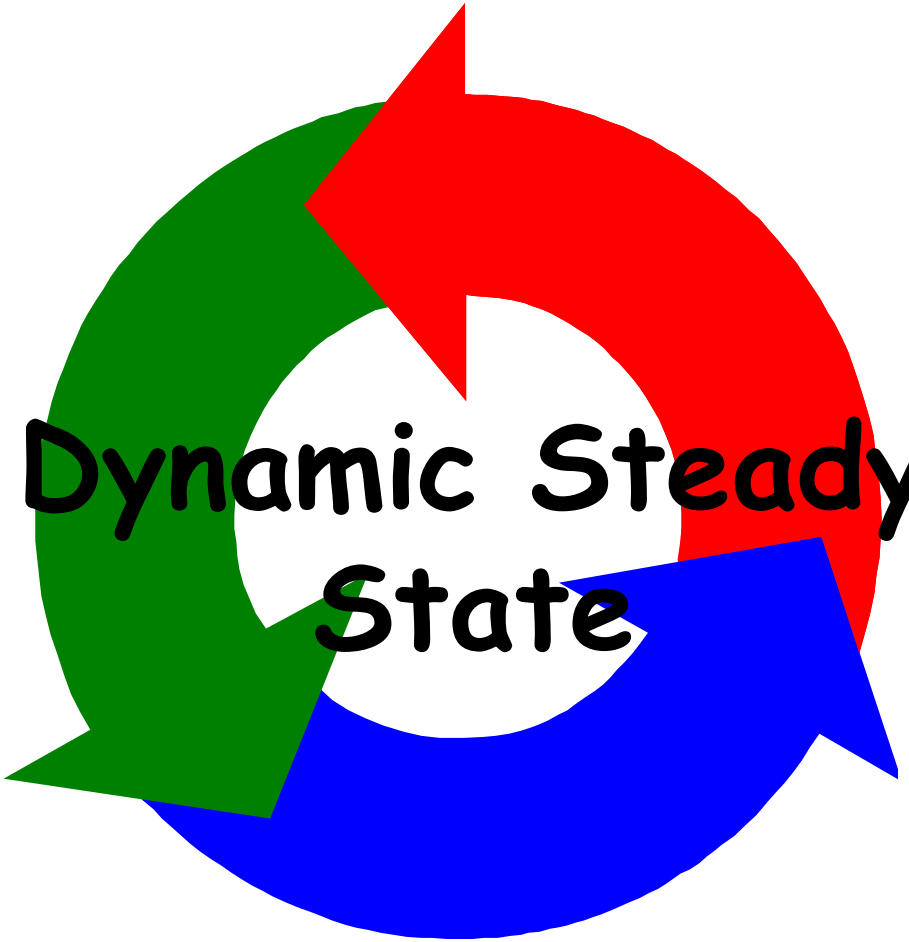
General Adaptation Syndrome

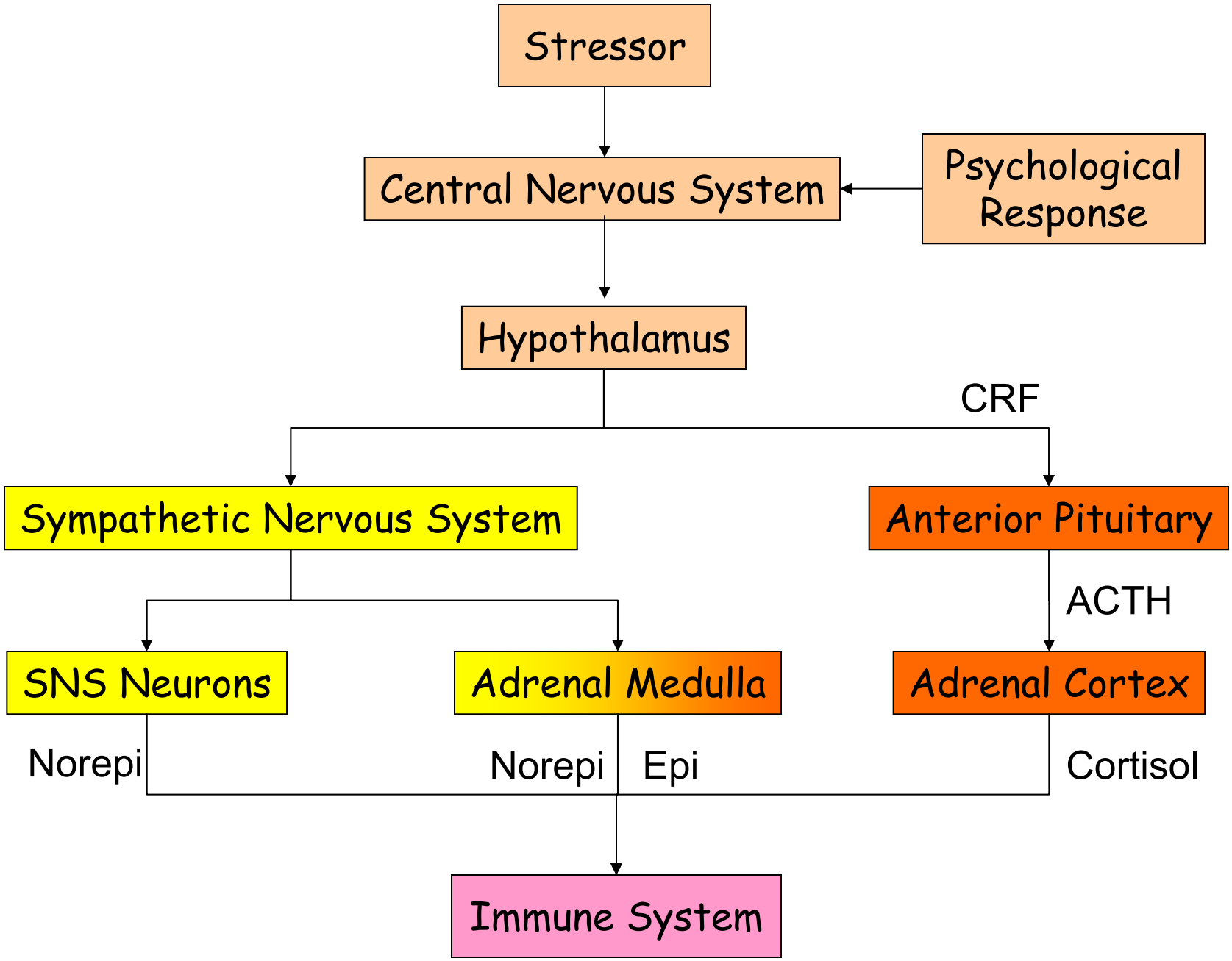


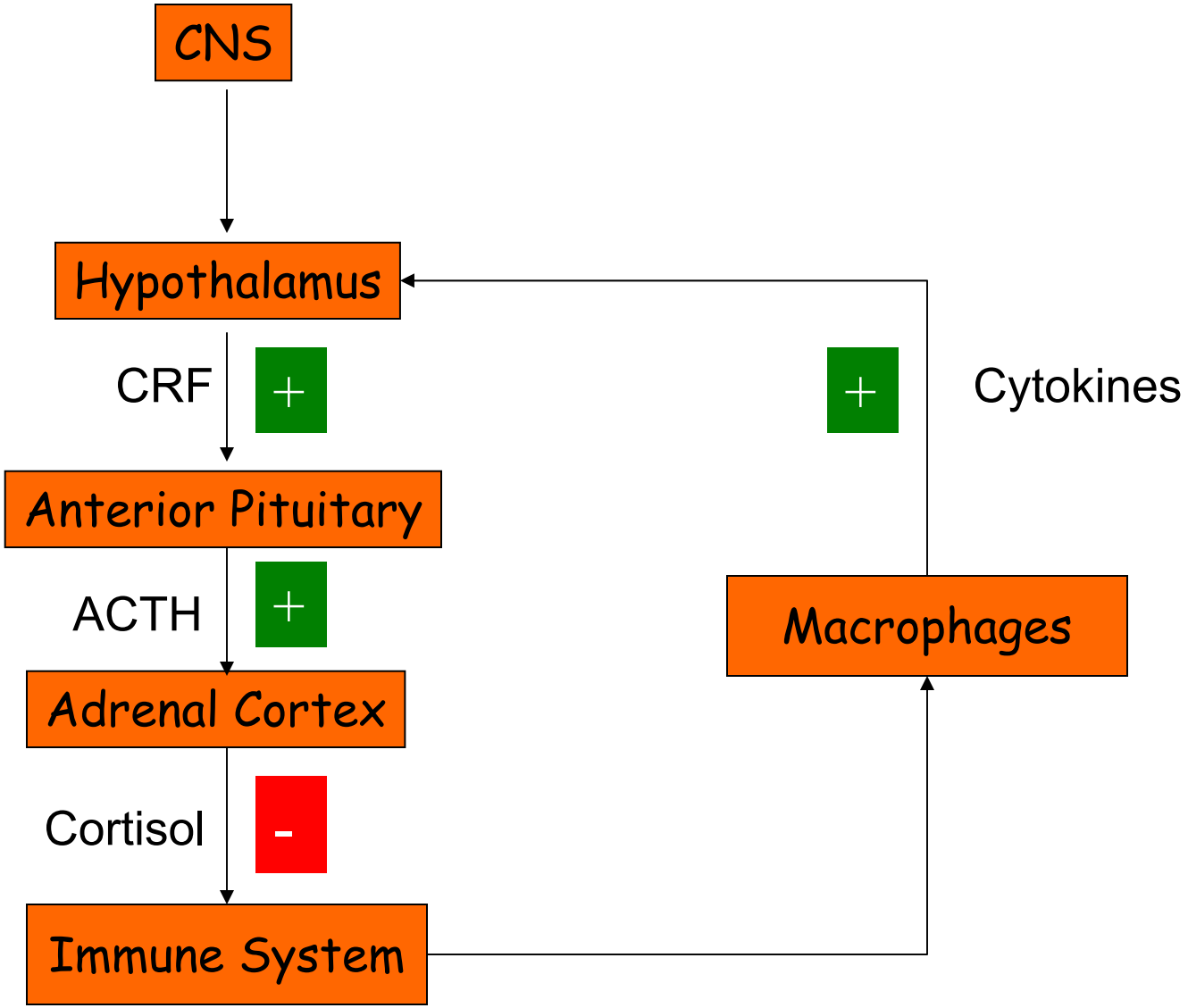
General Adaptation Syndrome



Homeostasis




Stressor
Central Nervous System
Psychological Response
Hypothalamus
CRF
Sympathetic Nervous System
Anterior Pituitary
ACTH
SNS Neurons
Adrenal Medulla
Adrenal Cortex
Norepi
Norepi
Epi
Cortisol
Immune System


CNS
Hypothalamus
CRF
+
Anterior Pituitary
ACTH
+
Adrenal Cortex
Cortisol
-
Immune System
+
Cytokines
Macrophages

Stress Response

Psychoneuroimmunologic

Alpha-Beta Effects

	1	2
Alpha	• Peripheral vasoconstriction • Mild bronchoconstriction • Increased metabolism	• Decreased NE release
Beta	• Increased heart rate, contractility, automaticity, conductivity	• Vasodilation • Bronchodilation

Catecholamine Effects

- Brain
  - Increased blood flow
  - Increased glucose metabolism
- Cardiovascular System
  - Increased heart rate, force of contraction
  - Peripheral vasoconstriction
  - Central vasodilation

Catecholamine Effects

- Respiratory System
  - Bronchodilation
  - Decreased work of breathing
  - Increased oxygen supply
- Liver
  - Increased glycogenolysis
  - Increased gluconeogenesis
  - Decreased glycogenesis

Catecholamine Effects

- Skeletal Muscle
  - Increased glycogenolysis
  - Increased dilation of blood vessels
- Adipose Tissue
  - Increased lipolysis
  - Increased fatty acids, glycerol

Catecholamine Effects

- Skin
  - Decreased blood flow
- GI, GU Tracts
  - Decreased blood flow
  - Decreased protein synthesis

Catecholamine Effects

- Skeleton
  - Decreased glucose uptake, use
- Lymphoid Tissue
  - Increased protein breakdown

Cortisol Effects

- Carbohydrate Metabolism
  - Increased gluconeogenesis
  - Decreased peripheral glucose uptake
  - Increased blood glucose levels

Cortisol Effects

- Protein Metabolism
  - Increased protein breakdown in muscle, lymphoid tissue, muscle, skin, bone
  - Increased blood amino acid levels
  - Decreased immunoglobulin levels
  - Increased synthesis of clotting factors, plasma proteins in liver

Cortisol Effects

- Lipid Metabolism
  - Increased lipolysis in extremities
  - Lipogenesis in face, trunk

Cortisol Effects

- Antinflammatory Effects
  - Decreased immunoglobulin production
  - Decreased lymphocytes, macrophages, eosinophils
  - Decreased interleukin production
  - Decreased cell-mediated immunity
  - Decreased inflammatory response

Cortisol Effects

- GI Tract
  - Increased secretions
- Connective Tissue
  - Decreased fibroblast proliferation
- Bone
  - Decreased bone formation

Other Hormones

- Beta-endorphins, increase = Decreased pain sensitivity; increased sense of well-being
- Growth hormone, increase = Increased utilization of protein, lipid, carbohydrate
- Testosterone, decrease
- Prolactin, increase

Stress Response: Up Side

- Elevated blood glucose, lipids, amino acids
- Elevated blood oxygen
- Shifting of blood flow to heart, lungs, brain, skeletal muscles
- Shifting of blood flow away from skin, gut, kidney

Stress Response: Down Side

- Elevated blood glucose = hyperglycemia, diuresis
- Elevated blood lipids = atherosclerosis
- Depressed immune response = increased infections, poor healing, allergies, autoimmune diseases
- Increased GI secretions, decreased motility = ulcers
- Increased skeletal muscle blood flow, metabolism = tension headaches, back aches
- Decreased testosterone = impotence
- Increased CNS metabolism = fatigue, depression, insomnia